PATENT SPECIFICATION 1 383 761

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F1R 3A3D11 3A3D12C 3A3D2 3A3D4D

(54) INHALATION DEVICE FOR USE WITH AN AEROSOL CONTAINER

(71) I, DAVID CHARLES WOODCRAFT, a British subject, of 52/54 High Holborn, London, do hereby declare the invention, which was communicated from ARMSTRONG-KROPP DEVELOPMENT CORPORATION, a Corporation organised and existing under the laws of the Commonwealth of Massachusetts, United States of America, of 423, La Grange Street, West Roxbury, Massachusetts, United States of America, for which I pray

SPECIFICATION NO 1383761

By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of ARMSTRONG-KROPP DEVELOPMENT CORPORATION, a Corporation organised and existing under the laws of The Commonwealth of Massachusetts, United States of America, of 423 La Grange Street, West Roxbury, Massachusetts, United States of America.

THE PATENT OFFICE

R 21445/11

describes and claims ... dispensing device for use with a pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle which is capable of releasing a metered amount of an aerosol compound upon relative movement of the valve nozzle and the container body towards one another, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means responsive to suction applied to said mouthpiece to release said latch means whereby in use of the device said actuating means causes actuation of the valve of said aerosol dispensing container and discharge of a metered amount of an aerosol compound into the chamber in the vicinity of the mouthpiece.

Although the above-mentioned specification envisages a wide variety of different means for triggering the inhalation device, it is particularly concerned with devices which incorporate a rubber membrane or diaphragm which is deflected by suction applied to the mouthpiece.

It has now been discovered that it is advantageous to employ as the triggering means a wall member which is moveable under the influence of the air flow into the chamber by applying suction to the mouthpiece.

According to the present invention there is provided a device for use with a pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle which is capable of releasing a metered amount of an aerosol compound upon relative movement of the valve nozzle and the container body towards one another, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means responsive to suction applied to said mouthpiece to release said latch means whereby in use of the device said actuating means causes actuation of the valve of said aerosol dispensing container and discharge of a metered amount of an aerosol compound into the chamber in the vicinity of the mouthpiece, the triggering means being operative to release the latch means when the wall member is moved from a first position to a second position under the influence of air flowing through the port in response to suction applied to the mouth piece.

In one preferred embodiment, the wall member is located close to and overlies the air admission port when the wall member is in its first position. Although the wall member may be arranged to move bodily under the influence of the suction induced air flow, it is usually more convenient to pivotally mount the wall member in the chamber so that the pivotal movement of the wall member occurs in operation of the device.

In one preferred arrangement, the wall member and the chamber are so shaped and dimensioned that the wall member substantially fits the interior of the chamber without however being such a tight fit as to prevent leakage of air past the wall member. It is advantageous to so shape the wall member and/or the internal surfaces of the chamber

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This invention relates to inhalation devices of the kind which when fitted with an aerosol container including a medicament are capable of dispensing a measured quantity of medicament into the respiratory tract of a patient. The present invention may be regarded as an improvement or modification of the invention disclosed in the Specification of British Patent No. 1,288,971.

The above-mentioned Patent Specification describes and claims an inhalation actuable dispensing device for use with a pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle which is capable of releasing a metered amount of an aerosol compound upon relative movement of the valve nozzle and the container body towards one another, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means responsive to suction applied to said mouthpiece to release said latch means whereby in use of the device said actuating means causes actuation of the valve of said aerosol dispensing container and discharge of a metered amount of an aerosol compound into the chamber in the vicinity of the mouthpiece.

Although the above-mentioned specification envisages a wide variety of different means for triggering the inhalation device, it is particularly concerned with devices which incorporate a rubber membrane or diaphragm which is deflected by suction applied to the mouthpiece.

It has now been discovered that it is advantageous to employ as the triggering means a wall member which is moveable under the influence of the air flow into the chamber by applying suction to the mouthpiece.

According to the present invention there is provided an inhalation device for use with an areosol container capable of discharging a metered amount of an aerosol formulation upon its nozzle portion being pressed, said device comprising a chamber with which communicates a mouth piece and into which opens an air admission port, actuating means disposed within the chamber for pressing the nozzle portion of the aerosol container, latch means for holding the actuating means in a cocked position against a bias provided by resilient means, and triggering means comprising a wall member disposed within the chamber between the mouth piece and the port, the triggering means being operative to release the latch means when the wall member is moved from a first position to a second position under the influence of air flowing through the port in response to suction applied to the mouth piece.

In one preferred embodiment, the wall member is located close to and overlies the air admission port when the wall member is in its first position. Although the wall member may be arranged to move bodily under the influence of the suction induced air flow, it is usually more convenient to pivotally mount the wall member in the chamber so that the pivotal movement of the wall member occurs in operation of the device.

In one preferred arrangement, the wall member and the chamber are so shaped and dimensioned that the wall member substantially fits the interior of the chamber without however being such a tight fit as to prevent leakage of air past the wall member. It is advantageous to so shape the wall member and/or the internal surfaces of the chamber

that as the wall member moves towards its second position, a larger gap is provided for air to flow past the wall member.

The invention includes within its scope a device as described above fitted with an aerosol container which is filled with a pharmaceutical formulation useful in inhalation therapy.

Several embodiments of inhalation devices in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is an elevation partially in section of a first embodiment of the present invention, depicted in the actuated position and taken along line 2—2 of Figure 3;

Figure 2 is an elevation partially in section corresponding to Figure 1, but with the device in its cocked and locked position;

Figure 3 is a top view of the device of Figures 1 and 2 depicted in the cocked and locked position;

Figure 4 is a section along line 4—4 of Figure 1;

Figure 5 is a rear view of the device of Figures 1 and 2;

Figure 6 is an elevation partially in section of a second embodiment of the invention in its cocked and locked position;

Figure 7 is an elevation in section of the device of Figure 6 in the actuated position;

Figure 8 is a front view of the device of Figures 6 and 7;

Figure 9 is a rear view of the device of Figures 6 and 7;

Figure 10 is a top view of the device of Figures 6 and 7;

Figure 11 is a section along line 11—11 of Figure 6;

Figure 12 is a detail of the leaf spring and linking lever of the device of Figures 6 and 7; and

Figure 13 is a partial elevation showing a second version of the sliding cover.

The first embodiment of the improved device of the present invention is shown in Figures 1 to 5. The device indicated generally at 21, is a generally rectangular box-like structure molded from a rigid thermoplastic material such as high-impact polystyrene, in two symmetrical halves indicated at 22 and 23, joined together. The device 21 is provided with a front wall portion 24, a rear wall porton 25, a right side 26, a left side 27, a top 28, and a bottom 29. A forwardly extending portion 31 near the bottom of front wall portion 24 together with a corresponding extension at the bottom of right side 26, left side 27 and bottom 29, forms a mouthpiece 32 with a substantially rectangular aperture 33 of convenient size to be held between a person's lips. An internal wall 34 having a generally vertical portion 35 and a horizontal portion 36 divides the interior of device 21 into two chambers, namely chamber 37 for receiving an aerosol container and an operating chamber 38. The internal wall 34 is continuous except for an aperture 39 provided in horizontal portion 36 at the bottom of aerosol container-receiving chamber 37 to receive the valve nozzle portion 49 of an aerosol container 43 within operating chamber 38. Rear wall portion 25 is provided with a plurality of horizontal air-admitting slots or ports 41, which when the mouthpiece 32 is held in a person's mouth provides the only important access for entry of air into operating chamber 38. Walls 24, 34 and portions of walls 28 and 29 are provided with an internal groove in left half 23 (the half shown in Figures 1 and 2) and a corresponding tongue in right half 22, to facilitate the matching of the two halves and to provide an airlock along the line of juncture.

A standard medicament aerosol container is indicated at 43. Such containers are provided in glass, metal or plastics (a typical glass container is shown) and while there are some minor structural differences between the three, all three are made to a standard size and all conventionally have a container body 44 with a neck portion 45, a cap 46, a cylindrical extension 47 on cap 46, a valve stem 48 and a nozzle portion 49. Nozzle portion 49 is generally rectangular in cross-section with flat parallel sides. The standard aerosol container is designed to be operated in the inverted or valve-down position and to expell upon pressure a measured amount of a mixture of propellant and medicament horizontally from nozzle portion 49 each time nozzle portion 49 is pressed toward container 44. Aerosol container-receiving chamber 37 is of a size to receive the standard aerosol container 43 with the shoulder of cap 46 resting against the top of horizontal wall portion 36 and with cylindrical extension 47, valve stem 48, and nozzle portion 49 extending into operating chamber 38 through aperture 39 with outlet 50 of nozzle portion 49 adjacent to and substantially at the center of mouthpiece aperture 33. Guiding slots 52 and 53 are provided on the inside of side walls 26 and 27, both to ensure the proper entry of container 43 into chamber 37 and to minimize the width of the device 21.

Chamber 37 is provided with a cover portion 54 pivotally mounted as indicated at 55 at one end between the side walls at a point adjacent internal wall 34. The other end of cover portion 54 is provided with a forwardly extending finger grip 56 which extends through a recess provided therefor at the top of front wall 24. At each side of grip 56 a series of interlocking ridges, indicated at 57, are provided both on the forward end of cover 54 and the inside of front wall 24, to retain cover 54 in place. The bottom of

cover 54 is provided with an upstanding bead 58 adapted to press against the bottom of container 43. With cover 54 raised container 43 can easily be introduced into or removed from container-receiving chamber 37. When cover 54 is locked into position by interlocking ridges 57 by pressure on its top, container 43 is retained in chamber 37.

The actuating mechanism is substantially identical to that disclosed and claimed in the aforesaid Patent Specification and comprises a movable wall portion 61, a linking lever 62, an actuating lever 63 and a spring 64. Such modifications as have been made were made for ease and reliability of manufacture, and ease and reliability of assembly. It will be noted as explained below that there are only five parts other than the two shell halves 22 and 23; that there are no sub-assemblies except to link one end of spring 64 to actuating lever 63, and all of the parts except for spring 64, the other end of which is slipped over a post 80 provided therefor between the two shell halves, are pivotally mounted between opposed sockets provided in the two shell halves, so that the entire assembly can be put together very rapidly and very easily.

Movable wall portion 61 is a substantially flat plate which substantially fills the cross-section of the chamber 38. The wall portion 61 is pivotally mounted at the bottom by a pair of studs 65, one of which is provided on each side and each of which is adapted to fit into a socket 70 provided therefor in side walls 26 and 27. A raised portion 66 is provided on the interior side thereof to provide a bearing surface for one end of linking lever 62.

Linking lever 62 is provided at an intermediate portion with a pair of opposed studs 67 adapted to fit into sockets (not shown) provided therefor on the inner walls of sides 26 and 27 to act when aseembled as a pivot. A centrally disposed enlongated arm portion 68 is provided above studs 67 and a relatively short blade portion 69 is provided below studs 67. Arm portion 68 is provided on one side at its end with a rounded knob portion 71 adapted to ride against raised portion 66 of movable wall 61. The lower end of blade portion 69 is provided with a flat surface 72 which acts as the catch. Surface 72 is tapered slightly so that the edge closer to actuating lever 63 is slightly closer to studs 67 than is the edge away from the actuating lever 63. The back of arm portion 68 is provided with a rounded raised portion 73 at a position slightly above studs 67 adapted to rest against spring 64 and thereby to bias knob 71 and, correspondingly, movable wall 61, toward rear wall 25.

Actuating lever 63, resetting strap 74 and mouthpiece cover 75 are injection molded as a one-piece assembly. Actuating lever 63 is provided at one end with a pair of opposed studs 76 adapted to fit into a pair of sockets (not shown) provided therefor on the inside of side walls 26 and 27 to provide a pivot mounting. The body of lever 63 is formed as an inverted saddle with two side walls 77 adapted when the device 21 is assembled and aerosol container 43 is in place therein, to overlie closely on each side the flat sides of nozzle portion 49. Side walls 77 are connected by bottom wall 78. Bottom wall 78 is formed, adjacent studs 76, in an inverted V-shape providing on the top thereof a relatively sharp edge 79 adapted to press against the end of each nozzle portion 49. At a point remote from the studs 76 beyond the location of nozzle portion 49, there is provided a web portion 81 between side walls 77 of actuating lever 63. Beyond web portion 81, bottom wall 78 is thickened slightly as a strengthening measure and terminates in a generally cylindrical portion 82 which is separated from side walls 77 and is adapted to receive a loop at one end of coil spring 64. The loop at the other end of spring 64 passes around mounting post 80 provided between side walls 26 and 27 adjacent top 28. The arrangement of the parts is such that the side of spring 64 presses against rounded portion 73 of linking lever 62 as the device is being cocked to bias movable wall portion 61 toward rear wall 25.

Side walls 77 of actuating lever 63 extend beyond the location of spring 64 passing therebetween and a notch 83 is provided at the intersection of the top of each side wall 77 with that end of each side wall 77 remote from studs 76. The two aforesaid notches are adapted to engage surface 72 of blade portion 69 of linking lever 62 to act as a latch.

Resetting strap 74 extends from cylindrical portion 82 beyond the location of the lower end of the spring 64 through a slot 84 provided therefor in bottom wall 29. A groove 85 is provided on the bottom or back side of strap 74 at a position adjacent the outside of bottom wall 29 when the device is in its cocked position to act as a bend line. Strap 74 terminates in mouthpiece cover portion 75 adapted to cover aperture 33 of mouthpiece 32. A second groove or thinned portion 86 is provided at the intersection of strap 74 and cover portion 75 also to act as a bend line. The length of 74 is such that when cover portion 75 is in place over mouthpiece 32 the latch of actuating lever 63 is slightly removed from the catch of linking lever 62 as shown in Fig. 2 so that no movement of movable wall 61, while the device is in the storage position, can uncock the device. The release of cover 75 from mouthpiece 32 permits the catch to re-engage the latch under the force of spring 64 placing the device in condition for instant use.

The upper end of cover portion 75 is provided with an inward extension 87 having a groove 88 adapted to engage a ridge 89 provided on the upper outer end of upper wall 31 of mouthpiece 32. A ridge 91 is provided across a midpoint on the inside of cover piece 75 of an extent substantially equal to the width of aperture 33 to ensure that cover 75 will cover mouthpiece 32 when in position.

The release of cover 75 from mouthpiece 32 permits the catch and latch to engage and further permits the mouthpiece to be placed in a person's mouth as indicated in Fig. 1. Upon the inhalation by that person the pressure is reduced within operating chamber 38 creating a pressure differential between the side of movable wall portion 61 adjacent air-admitting ports 41 in rear wall 25 and the side facing chamber 38. As soon as the pressure differential is sufficient to overcome the biasing force imposed upon linking lever 62 by contact between the side of spring 64 and rounded portion 73 on the rear of linking lever 62, movable wall portion 61 pivots about studs 65 causing the linking lever 62 to pivot about studs 67, releasing the latch at the lower end of linking lever 62 from the catch at the outer end of actuating lever 63. As soon as this happens spring 64 is permitted to retract, forcing sharp edge 79 on bottom 78 of actuating lever 63 against the end of nozzle 49 of aerosol container 43, causing aerosol container 43 to discharge a metered discharge through aperture 33 of mouthpiece 32 into the mouth of the person. The instant of discharge is shown in Fig. 1.

Means for admitting outside air into operating chamber 38 at the instant of discharge to eliminate the reduced pressure within chamber 38 permitting the person to complete his inhalation cycle and acting as a scavenger to force the discharge deep into the bronchi and pulmonary regions is provided by providing the upper portion of side walls 26 and 27 with a pair of recesses 92 and 93, which recesses extend across top wall 28 as indicated at 94 at a position in front of the location of movable wall portion 61 when in its cocked position next to rear wall 25 as in Fig. 2 but at the position assumed by the upper end of movable wall portion 61 upon discharge as shown in Fig. 1.

Since movable wall portion 61 substantially fills the cross-section of operating chamber 38 when the wall portion is in its cocked position adjacent rear wall 25, very little air is admitted into chamber 38 during the initial part of the person's inhalation cycle. It has been determined that some air leakage into chamber 38 is desirable since this prevents the device from being actuated by a mere sucking action and requires that there be an actual inhalation into the lungs. In addition either this leakage or the fact that the movable wall portion is pivotally mounted at one end increases both the sensitivity and the reproducibility of operation of the device. As soon as the device triggers movable wall portion 61 pivots to a position where it is surrounded at its upper end by recesses 92, 93 and 94 which in the actual device measure about $1\frac{1}{2}$, $1\frac{1}{2}$ and 1 in. long respectively by $\frac{1}{16}$ in. in depth. The total area of these recesses, amounting to $\frac{1}{4}$ square inch, is approximately the same in area as the aperture shown in the embodiments shown in the above-mentioned specification and therefore permits the instantaneous ingress of approximately an equal amount of outside air.

The device is reset by pulling on strap 74, which pulls down actuating lever 63 against the force of spring 64 permitting the catch of linking lever 62 to engage the latch of actuating lever 63. At the same time contact between spring 64 and rounded portion 73 of linking lever 62 biases the movable wall portion 61 toward rear wall 25.

The embodiment of the device 21 shown in Figs. 1 to 5 has been subjected to a very extensive testing program under field conditions. As a result of this testing a number of refinements were made, resulting in the embdiment shown in Figs. 6 to 13 wherein as to most of the parts which remain unchanged the same numbers are assigned as in Figs. 1 to 5.

Referring to Figs. 6 to 13, the overall shape of the device 21 has been modified slightly to conform better to the shape of the hand. Thus since the width of the hand at the location of the little finger is less than the width of the hand at the location of the first three fingers, the bottom of rear wall 25 has been rounded in slightly with movable wall 61 shaped to conform. So also side walls 26 and 27 have been rounded in correspondingly adjacent their intersection with bottom portion 29. In addition the forward ends of side walls 26 and 27 have been rounded in adjacent their junction with front wall 24 to better conform to the typical shape of a bent thumb. As pointed out above, these changes in shape make the device 21 easier and more comfortable to hold as well as making the overall appearance aesthetically more pleasing.

As far as rear wall 25 is concerned, it was discovered on field testing that there were two deficiencies. One was that the plurality of air-admitting ports 41 tended to pick up dust, dirt and lint from the inside of pockets and pocketbooks, and proved to be difficult to clean. In addition there were a number of people who felt the need of a panic button — something that they could push to trigger the device, if, for example, they were in the midst of an asthma attack. As a result, it was decided to provide a single round aperture 101 as the air-admit-

ting port. A matching button 102 is provided on the face of movable wall portion 61. Button 102 is provided with an upstanding peripheral wall portion 103 designed to fit closely against shoulder 104 provided around the periphery of aperture 101. Button 102 is provided with a depressed central panel 105 in order to avoid the possibility that the device could be triggered inadvertently because of accidental contact between the side of a finger and button 102. The close contact between shoulder 104 of aperture 101 and the peripheral wall portion 103 effectively keeps dirt out of space between movable wall portion 61 and the inner sides of rear wall 25. The area of aperture 101 is such (the diameter is about $^{11}/_{16}$ inch) that upon a slight reduction of pressure within operating chamber 38 wall portion 103 moves slightly away from shoulder 104 admitting outside air to the entire back side of movable wall portion 61.

One unexpected development was that there turned out to be a wide variation in the force required to actuate various aerosol container valves. This variation is not very critical when such valves are actuated manually since a person's thumb can develop a substantial amount of force. It becomes quite critical, however, when the force is applied by a spring attached to a lever arm, since if the designed force applied is insufficient, it can be increased only by increasing the mechanical ratio of the lever arm or increasing the strength of the spring. A change in the ratio of the lever arm is impractical since this because of space limitations would require a complete redesign of the entire housing. On the other hand, a change in the strength of the spring necessarily changes the biasing force of the spring against linking lever 62, thereby changing the actuating pressure differential. Of course the desired actuating pressure differential could be reestablished by changing the internal geometry either by moving the location of mounting post 80 or by changing the shape of rounded raised portion 73 on linking lever 62, or both. On the other hand, it was deemed undesirable to provide all of the devices 21 with a spring of increased strength merely to accommodate that small percentage of metering valves which require an excessively high operating pressure, or in the alternative, to provide a number of different models of the device differing only in the location of mounting post 80 and/or the shape of linking lever 62.

It was decided therefore to eliminate raised portion 73 from the front of linking lever 62 and to re-locate mounting post 80 so that spring 64 would at all times be free of contact with linking lever 62. At the same time a separate biasing spring 107 was provided to bias linking lever 62 and correspondingly movable wall portion 61 toward the cocked position. This is shown in detail in Fig. 12. Spring 107 is provided with a generally rectangular slot 108 arranged axially internally thereof in the upper portion for the passage of elongated arm portion 68 of linking lever 62 therethrough. A notch 109 is provided on the front face of elongated arm portion 68 to receive the upper end of spring 107. Leaf spring 107, which is substantially of the same width as blade portion 69, extends around elongated arm portion 68 behind pivot studs 65 and terminates in front of a mounting stud 110 provided therefor between sides 27 and 26 just in front of and above studs 67. An additional advantage of the separation of the actuating function of spring 64 from the biasing function is that as soon as the internal pressure within operating chamber 38 returns to normal after the actuation of device 21 movable wall portion 61 returns to its normal position in contact with the inner side of rear wall portion 25 under the influence of biasing spring 107 as indicated in Fig. 7.

Another problem that developed was that it was possible to insert aerosol container 43 so that outlet 50 of nozzle portion 49 was facing in the wrong direction so that upon actuation the discharge was directed toward the interior of operating chamber 38 rather than through mouthpiece 32 as desired. This possibility has been eliminated by providing the rear of nozzle portion 49 with an outstanding boss 112 and aperture 39 with a corresponding slot 113. If boss 112 is aligned with slot 113 as container 43 is inserted into chamber 37, nozzle portion 49 will pass into operating chamber 38 as desired. Unless the boss and the slot are aligned, container 43 cannot be inserted completely into chamber 37.

There have been a number of design changes in actuating lever 63. Side walls 77 have been extended to more completely surround the sides of nozzle portion 49. The sharp edge 79 on the inside of bottom 78 has been replaced by a rounded portion 115 to provide a better bearing surface against nozzle 49. The details of the mounting of integral strap 74 and of the lower end of spring 64 have been changed for increased strength. Strap 74 now extends the full width of bottom 78 and the lower end of spring 64 is now mounted in a metal pin 116 that passes between apertures provided for that purpose in side walls 77 in the portion behind web 81. Reinforcing members 117 may be provided on the inside of side walls 77 to further reinforce and strengthen pin 116 and side walls 77.

While the volume of air admitted through air-admission ports 92, 93 and 94 was sufficient, there were some who believed that

there was an advantage in admitting outside air into operating chamber 38 upon the triggering of device 21 from a position just behind nozzle portion 49. Accordingly in the embodiment shown in Figs. 6 to 13 an additional air-admission port has been provided in the form of an aperture 121 in bottom wall 29, which aperture is closed off when the device is in its cocked position by resilient foam pad 122 formed of a material such as a closed-cell neoprene foam adhesively mounted to bottom 78 of actuating lever 63. Aperture 121 is substantially square-shaped with a dimension of about $\frac{1}{4}$ inch more or less on each side.

Finally the design of cover portion 54 was such that it proved difficult to manufacture in that its proper operation depended upon the maintenance of precise dimensions in three separately molded parts — cover portion 54, right half 22 and left half 23. If the distance between the effective center of pivot 55 and interlocked ridges 57 in cover portion 54 increases relative to the corresponding distances in the shell of the device 21, the cover becomes difficult to press into position. On the other hand, if this distance in cover portion 54 decreases relative to the corresponding distance in the shell, the cover will not lock at all. In any event, the interlocking ridges 57 tend to wear down with use. All in all the arrangement proved to be intolerant of variations within normal manufacturing tolerances.

In place thereof a sliding cover 125 has been provided that extends over the entire top of the device 21. To accomplish this side walls 26 and 27 and front wall 24 are extended above top wall 28 and a horizontal groove 126 is provided on the inside thereof to receive tongue 127 on cover 125. A pressed against internal wall 36. Sliding and near the rear of cover 125 to act as a finger grip. The underside of cover 125 is provided with a sliding wedge 129 designed to wedge against the top of aerosol container 43 to hold it in place with cap 46 depressed panel 128 is provided on the top wedge 129 has a transverse web portion 131 designed to ride in groove 126 beneath cover 125, a depending wedge portion 132 that tapers forwardly upwardly and an upstanding boss 133 adapted to ride in a groove 134 provided axially therefor in the underside of cover 125. In one version the top of boss 133 and the bottom of groove 134 are provided with interlocking V-shaped notches 135. In this version a second groove 136 is provided on the underside of cover 125 to engage knob 137 provided on top of web 131 of sliding wedge 129. This knob and second groove limits the travel of wedge 129 relative to cover 125.

Rear wall portion 25 is provided with a portion 138 which extends above top wall 28 sufficiently to permit clearance between top wall 28 and the bottom of sliding wedge 129 and to act as an abutment for the rear of sliding wedge 129 while permitting cover 125 to pass. Thus as cover 125 is slid back, the rear of wedge 129 is forced against abutment 138 which pushes wedge 129 toward the forward edge of cover 125 where its further movement is prevented by grooves 134 and 136, thus preventing further movement of cover 125 as soon as chamber 37 is completely opened. After aerosol container 43 has been pressed into position in chamber 37, cover 125 is pushed forward. Initially, as the forward end of wedge portion 132 starts to slide up on the bottom of container 43, wedge 129 is relatively free to slide backward relative to sliding cover 125. As wedge 129 continues to slide forward over container 43 the resistance to movement because of the interaction of notches 135 increases sufficiently to lock wedge 129 relative to cover plate 125. Further movement of cover plate 125 forces the container 43 into position in chamber 37. A ridge 139 is provided on the bottom of sliding cover 125 in a position to engage the inside of abutment 138 to hold cover 125 in its closed position.

This arrangement works very well in the case of metal aerosol containers where tolerances can be maintained carefully and the overall distance between the outside of tap 46 and the bottom of aerosol container 43 varies but a few thousandths of an inch at the most. In the case of glass containers where the variation may be as much as $\frac{1}{8}$ inch some degree of jamming sometimes results. In such instances a second version of the sliding wedge is preferred.

In this second version, shown in Fig. 13, notches 135 are entirely removed permitting boss 133 to slide freely in groove 134. Wedge 129 is urged forwardly by a spring 141 mounted between the rear of wedge 129 and abutment 138. A rearwardly extending lug 142 may be provided on wedge 129 to support one end of spring 141.

A further advantage of the present invention resides in the fact that the device as shown in the accompanying drawings can be made substantially silent in operation by a very simple modification. This involves bonding a thin layer of cellular rubber or plastics material to the wall 34 on the surface facing the spring 64. Surprisingly this simple modification suppresses substantially the whole of the noise made by the device when discharging and this is very desirable in practice since asthma sufferers tend to be nervous people who might be disturbed by the noise of the device discharging.

WHAT I CLAIM IS:—

1. An inhalation device for use with an

aerosol container capable of discharging a metered amount of an aerosol formulation upon its nozzle portion being pressed, said device comprising a chamber with which communicates a mouth piece and into which opens an air admission port, actuating means disposed within the chamber for pressing the nozzle portion of the aerosol container, latch means for holding the actuating means in a cocked position against a bias provided by resilient means, and triggering means comprising a wall member disposed within the chamber between the mouth piece and the port, the triggering means being operative to release the latch means when the wall member is moved from a first position to a second position under the influence of air flowing through the port in response to suction applied to the mouth piece.

2. A device according to claim 1, in which said wall member is pivotally mounted in said chamber.

3. A device according to claim 1 or claim 2 in which the wall member has a clearance gap between itself and side walls of the chamber which is less in the first position than in the second position.

4. A device according to any one of the preceding claims in which said resilient means biases said wall member towards said first position.

5. A device according to any one of claims 1 to 3, in which a second resilient means is provided to bias the wall member towards its first position.

6. A device according to any preceding claim, in which said port comprises a number of ports, substantially all of which are covered by the wall member when the latter is in its first position.

7. A device according to any of claims 1 to 5, in which the air admission port comprises a series of slots in a wall of said device.

8. A device according to any one of claims 1 to 5, in which said air admission port comprises an aperture in a wall of said chamber and said wall member includes a button substantially filling said aperture when the device is in its cocked position.

9. A device according to any one of the preceding claims which includes a second chamber for receiving and retaining said aerosol container and said device is provided with a sliding cover for said second chamber, said cover including a wedge member moveable relative thereto, said wedge member being adapted to press against the end of said container to retain the container in a fixed position in said second chamber when said cover is closed.

10. A device as claimed in any one of the preceding claims, in combination with an aerosol container filled with a pharmaceutical formulation useful in inhalation therapy.

11. An inhalation device substantially as described with reference to the accompanying drawings.

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1383761 COMPLETE SPECIFICATION
7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

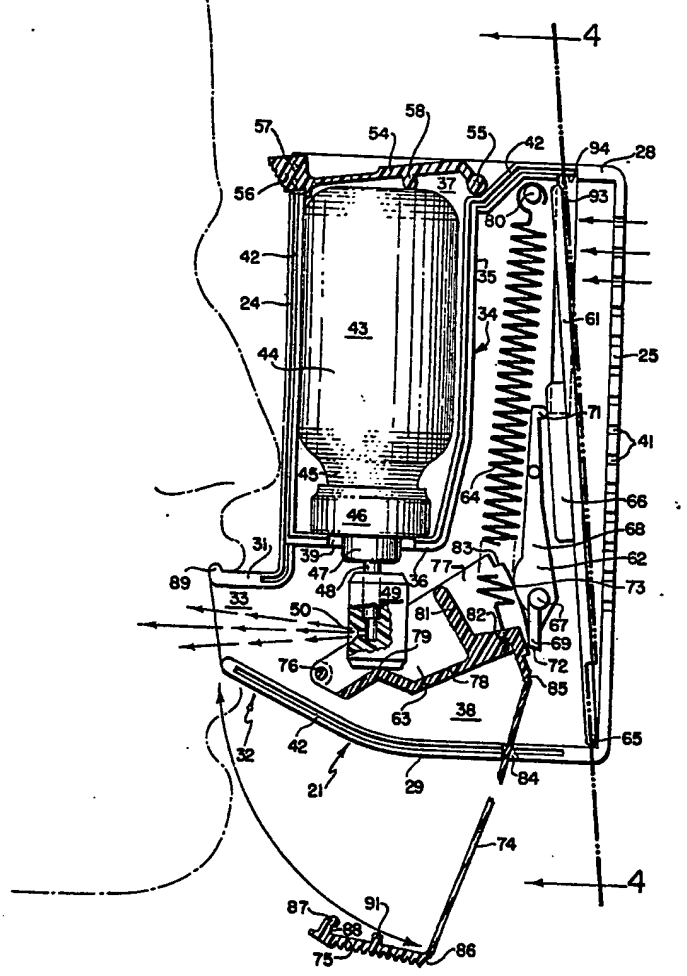

FIG. 3

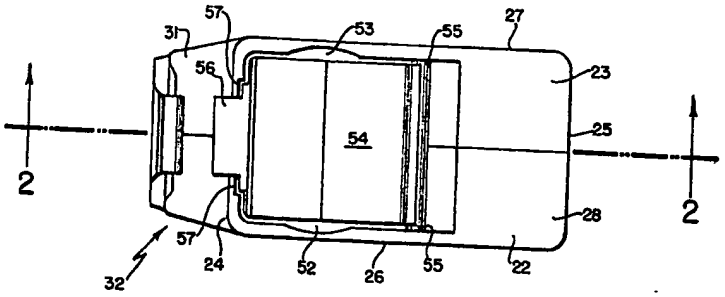
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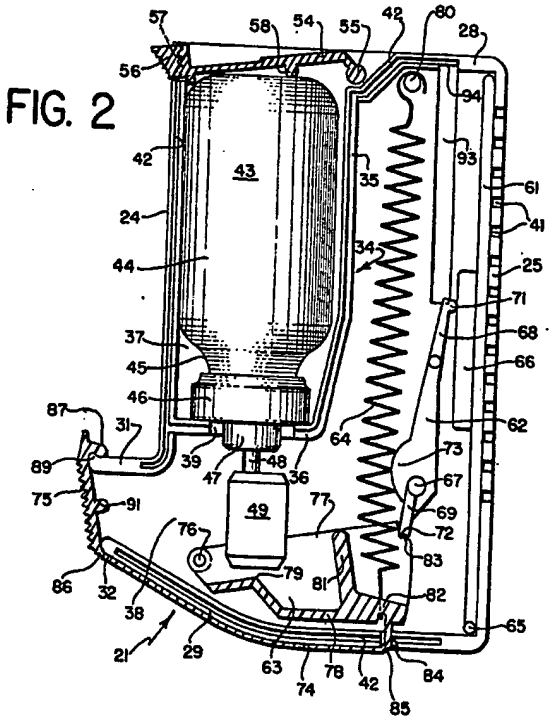
FIG. 2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1383761 COMPLETE SPECIFICATION
7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

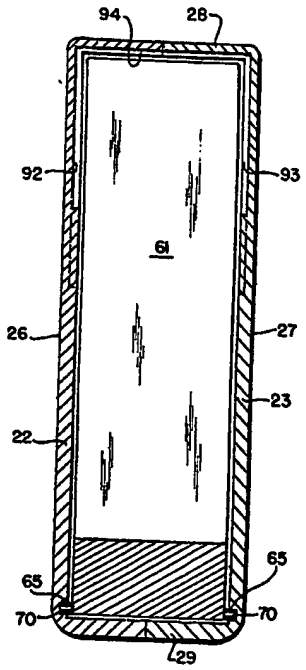
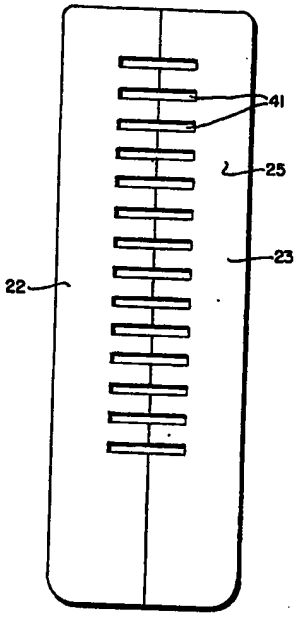


FIG. 4

FIG. 5



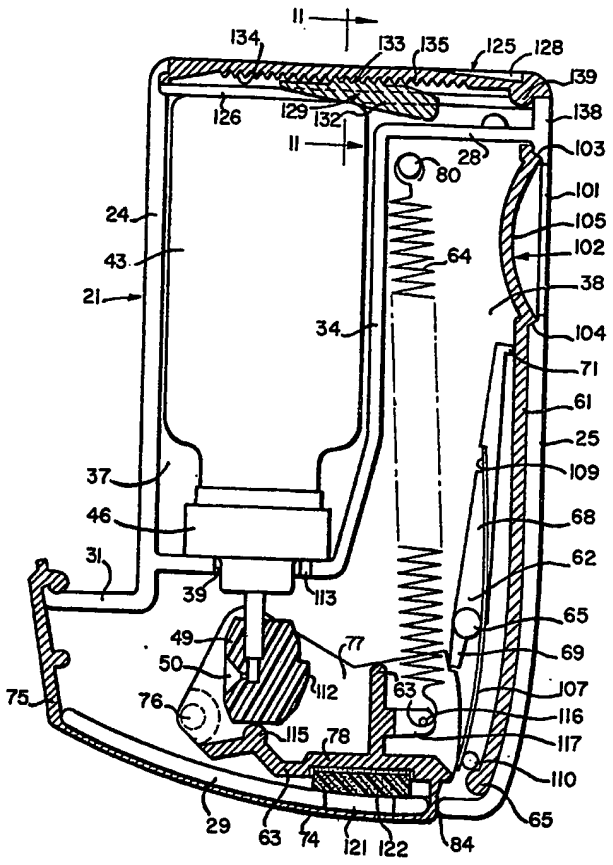

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FIG. 6

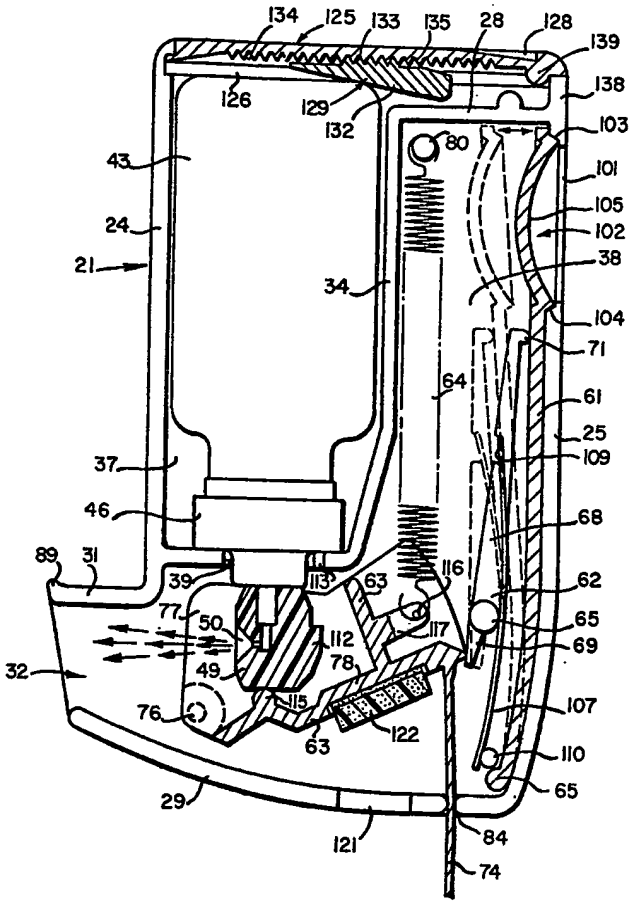
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FIG. 7

1383761 COMPLETE SPECIFICATION
7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 6

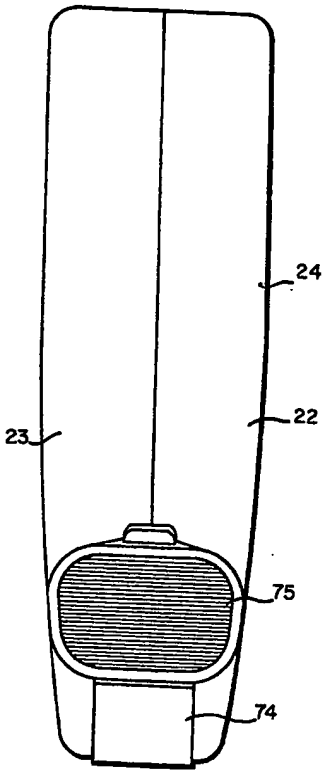

FIG. 8

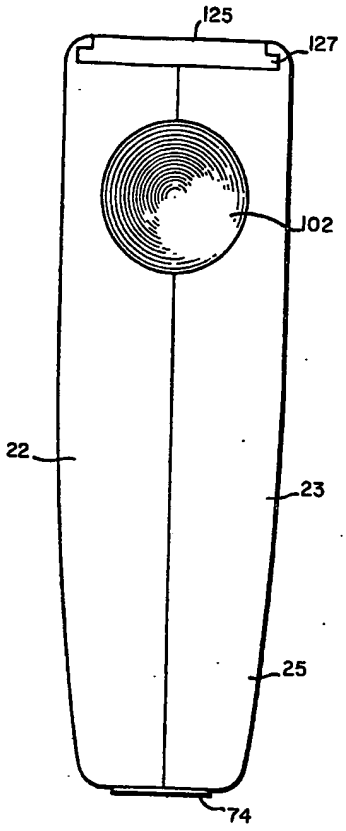

FIG. 9

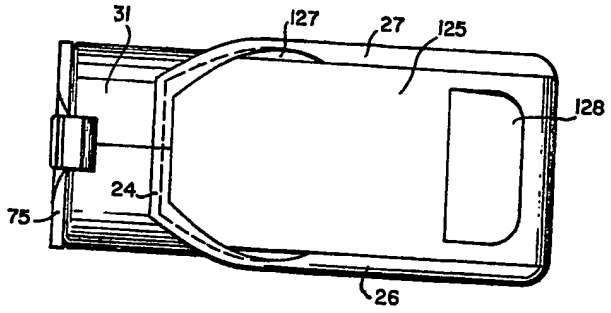

FIG. 10

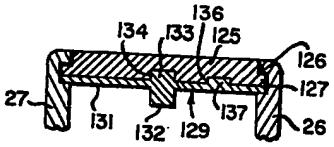

FIG. 11

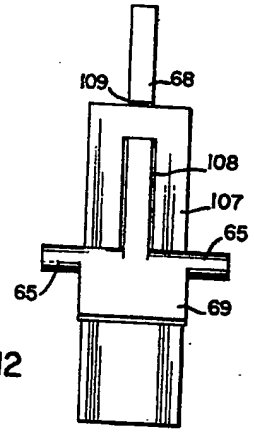

FIG. 12

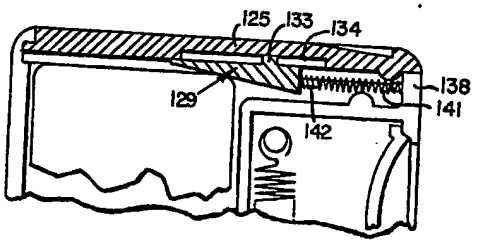

FIG. 13